

FACT SHEET
U.S. DEPARTMENT OF ENERGY
COOPERATION WITH THE
PEOPLE'S REPUBLIC OF CHINA
April 2006

DOE cooperation with China began in 1979 with an accord for cooperation in High Energy Physics. It now includes cooperation in fusion energy, fossil energy, climate change, energy efficiency and renewable energy, peaceful uses of nuclear technologies and energy information exchange. Technical and policy discussions occur under these agreements and through a number of consultative bodies. For instance, from 1997 to 2000, DOE and China's State Development Planning Commission (SDPC) co-chaired three sessions (March 1997, April 1999 and January 2000) of an Energy Policy Working to discuss energy policies, outlooks and opportunities for cooperation. In 2004, the bilateral energy consultations was revived by a Memorandum of Understanding on the establishment of the U.S.-China Energy Policy Dialogue, signed by DOE and the National Development and Reform Commission (a successor to the SDPC). The two agencies co-chaired the first meeting in Washington in June 2005, facilitating policy-level discussions on energy policies and plans, including supply security, energy efficiency, energy technology development. DOE also participates in interagency science and technology meetings and consultations.

The Department of Energy's cooperation with the People's Republic of China in energy and the environment areas is aimed at advancing U.S. environmental, security, trade, S&T and investment goals. With 1.3 billion people and annual GDP growth of 8-10 percent, China is the world's most populous and rapidly growing economy. It is the world's second largest energy consumer after the United States and growth in its energy demand will represent 25% of the increase in total world energy demand over the next 25 years. Heavy reliance on coal (70%) contributes to severe environmental problems and makes China the world's second largest greenhouse gas emitter (after the U.S.) and largest emitter of SO₂. China is the largest potential market for energy equipment, technologies and services for U.S. industry, with an estimated \$1 trillion investment needed over the next twenty years for energy infrastructure development, of which \$200-250 billion will be needed to finance foreign equipment and services.

China's is also a critical player in global energy security issues since its net oil imports are expected to rise from approximately 1 million barrels per day (mbd) at present to up to possibly 10 mbd by the year 2020, with a predominant dependence on the Middle East. China provides a major opportunity to leverage and commercialize U.S. S&T investments in clean coal, energy efficiency, renewable energy and nuclear technology, since it is the single largest future market for deploying such technologies.

Estimates point to large potential for these solutions in the Chinese market. For instance, China could potentially save 40-50% of its consumption in the industrial sector by raising industrial energy efficiency standards to international levels. China also is seeking to expand development of: its substantial renewable energy resources, which could have an estimated 253 gigawatts of potential wind energy capacity; its indigenous oil and gas resources; and to increase utilization of clean technologies in the power sector, now 70% dependent on coal.

HIGHLIGHTS OF DOE COOPERATION WITH CHINA:

Energy Efficiency:

DOE and China's State Development Planning Commission (SDPC) co-chair an Energy Efficiency Steering Committee, which coordinates activities in nine priority areas. These activities strive to promote cooperative ventures and practices and an energy efficiency policy framework that will result in economic and environmental benefits to both countries.

Chinese studies indicate that China has the technical potential to achieve a 40-50% reduction in energy use by raising its industrial energy efficiency level to international levels. The Chinese industrial sector is particularly important since it consumes nearly two-thirds of the commercial energy and is highly dependent on coal. China is also undergoing a critical phase of technology implementation and much of the industrial production capacity that will exist in China fifteen years from now has yet to be built. Therefore, technologies chosen today will affect the patterns and the efficiency of energy use for decades to come.

Cooperation in electric motor systems, which consume about 50 percent of China's electricity demand, has been a major area of mutual interest. Cooperation in electric motor systems has included: a forum held in conjunction with the International Institute for Energy Conservation (IIEC) on international motor standards and testing procedures and the formation of a workgroup to select a motor test procedure for China; completion of three workshops on motor systems; an experts' tour of Chinese industrial sites to identify potential case studies; a study on China's motors market; and a workshop on motor testing procedures. In addition, the UN Industrial Development Organization and China's SDPC are implementing the China Motor System Energy Conservation Program.

Cooperating agencies include USDOE, the American Council for an Energy-Efficient Economy, Lawrence Berkeley National Laboratory, and the China State Bureau of Technology Quality Supervision. The program plans to reduce greenhouse gases by improving motor systems in factories. Participants will develop educational materials, analysis tools and standards to optimize motor systems and will conduct training and demonstration projects. The pilot program, to be implemented in Shanghai and Jiangsu provinces, could then serve as a model for a national program tailored to China's needs. In the area of energy efficiency policy, the goal is to collaborate on policies to promote energy efficiency with emphasis on assessing the applicability of U.S. energy policy to China and assisting in standards development in China. China is currently implementing its Energy Conservation Law that was signed on November 1, 1997. At China's request, a workshop was held in Beijing in December 1997, at which U.S. experts discussed implementation of U.S. energy efficiency laws and policies at the Federal and local levels. Subsequent to the workshop, discussions and exchange of information have continued. Training and collaboration on standards for energy-efficient air conditioners and lamp ballasts has been completed and Lawrence Berkeley National Laboratory (LBNL) has obtained funding from the Energy Foundation to assist in a variety of capacity building and standards development activities.

Significant progress has been made in energy-efficient buildings. In the summer of 1999, the Natural Resources Defense Council (NRDC), with DOE funding, initiated a project to provide

technical assistance to the Chongqing Municipal Government to develop regulations for its recently enacted residential building design standard and to develop an energy code for public/commercial buildings. In May 2000, LBNL and the Natural Resources Defense Council (NRDC) jointly sponsored a one-week study tour in California on building energy standards for ten representatives from Chongqing and Beijing. NRDC is also working with Chongqing Architecture University and other experts on the development of a Model Energy Code for the Transition Climate Zone and is working with national officials in Beijing on the residential building energy code for the transition climate zone. In support of this effort, LBNL is providing training in computer energy simulation methods and analysis techniques and assistance in developing detailed hourly weather data.

Additional building activities include the proposed construction of an energy-efficient demonstration building and center in Beijing. A technical feasibility study identifying cost effective energy measures that could reduce this building's energy costs by up to 40% was completed. Design workshops held in Pittsburgh in December 1999 and in Beijing in April 2000 helped to incorporate these energy savings options into the overall building design. A Statement of Work was signed to proceed with construction of the building. The budget for this project is estimated at around \$7.57 million to be provided by China and \$4 million to be provided by the U.S. private sector and other project participants in cash and/or in-kind contribution of equipment, materials and professional services.

Fossil Energy

The United States and China are the two largest consumers and producers of fossil energy, including oil, natural gas and coal. It is expected that the Chinese energy demand for all energy sources will increase rapidly in the future due to economic expansion in its power, transportation, industrial, commercial and domestic sectors. With fossil fuels accounting for over 90 percent of Chinese energy consumption, the United States has assigned a high priority to maintaining long term technical cooperation with China on fossil energy issues. This technical cooperation is in the areas of government-to-government cooperation via the Fossil Energy Protocol, clean coal technology projects, and the Oil and Gas Industry Forum.

Fossil Energy Protocol. The Protocol for Cooperation in the Field of Fossil Energy Technology Development and Utilization was established between the Department of Energy of the United States and Ministry of Science and Technology of the People's Republic of China for the purpose of maintaining long-term technical cooperation. Under this protocol, five annexes have been established: Annex I for Power Systems; Annex II for Clean Fuels; Annex II for Oil and Gas; Annex IV for Energy and Environment Technologies; and Annex V for Climate Science. Each annex seeks to develop and implement cooperative tasks involving industrial, academic and governmental organizations from both countries. The Protocol is managed by the Permanent Coordinating Group, whose members are made up of representatives from both countries.

The status of projects under this Protocol is as follows:

- Annex I: (1) Electricity Grid Modeling for Planning Future Growth, Stability and Reliability completed December 2001; (2) IGCC site tour conducted June 2002; (3) FGD Technology Workshop planned for later in 2003.

- Annex II: A potential Pre-Feasibility Study for Poly-Generation Project is under review.
- Annex III: (1) A workshop on Natural Gas Capacity Building was held on August 5-95, 2002 in Beijing; (2) The coalbed methane training modules will be prepared and translated in preparation for a training session held in Wuxi, China for November 2003.
- Annex IV: Low NOx/Sulfur Dioxide Control Workshop scheduled for later in 2003; (2) Study of CO₂ Sequestration by Spraying Concentrated Aqueous NH₃ and Production of a Modified NH₄HCO₃ Fertilizer is underway.
- Annex V: Major accomplishments include: (A) A 2000- years time series (with resolution 10-30 years) of winter half- year temperature reconstruction for the middle and lower reaches of the Yellow River and Yangtze River; (B) Measurements of CH₄ emissions from agricultural systems over China and their effects on the carbon cycle. All tasks are actively progressing. A Science Team meeting is planned for the late 2003 in China.

Clean Coal Technology. The United States and China are the two largest coal producers and users in the world. China relies on coal for over 75% of its energy use and employs more coal miners than the rest of the world combined. Coal burning is a major cause of severe urban air pollution, an important area of concern and new initiatives in China, including efforts to deploy clean coal technologies. The U.S. is cooperating with China in clean coal technology, building on the experience in the U.S. Clean Coal Technology Program where, during a period of 13 years, 40 CCT projects have been demonstrated and many subsequently commercially deployed. Several clean coal projects are being carried out through the Energy and Environment Center in Beijing, a cooperative program between the U.S. and China operated through Tulane and Tsinghua Universities.

These projects focus on reducing emissions from utility and industrial boilers, as well as facilitating the entry of American equipment and expertise into the Chinese market for coal preparation machinery.

U.S.-China Oil and Gas Industry Forum. A U.S.-China Oil and Gas Industry Forum (OGIF) was established in 1998 to promote exchange that will assist China in its efforts to secure reliable and economical sources of oil and natural gas. The Forum is helping to identify and facilitate new opportunities for U.S. industry related to China's petroleum development. DOE, DOC, and SDPC have hosted six successful forums in 1998, 1999, 2001, 2002, 2004 and 2005. The OGIF brings together U.S. and Chinese industry and government officials to discuss the development of China's oil and gas sector and accelerate commercial cooperation.

Renewable Energy

The collaborative framework in renewables was established in 1995 with the signing of the *Protocol for Cooperation in the Fields of Energy Efficiency and Renewable Energy Technology Development and Utilization*. This Protocol has seven annexes, five of which relate to renewable energy. These five annexes address policy, rural energy, large-scale wind systems, hybrid village power, renewable energy business development, and geothermal energy.

Cooperation in *Rural Energy Development* - focuses on the use of village scale renewable energy technologies to provide energy or electricity to rural areas in China. Cooperative projects have included: the Asia Pacific Economic Cooperation (APEC) Tibet Solar Electrification Project where two companies are currently installing 200 solar home systems (30-36 W systems) in rural areas of Damschung and Phendrop counties within the Lhasa prefecture with the goal of identifying business development strategies for PV installations in Tibet; a Great Wall PV demonstration site where a PV school and home demonstration project near Beijing was established in October 1999 to educate local people in solar energy and to demonstrate examples of the U.S./China bilateral cooperation pilot projects that have been implemented in remote areas around the country; training through DOE's National Energy Renewable Laboratory (NREL) on solar energy, rural electrification and renewable energy policy; letters of intent for cooperation in China's Brightness Program, which is China's largest rural electrification program aimed at completing 450,000 solar home systems and 500 village systems in its first phase.

Cooperation in *Wind Energy Development* focuses on accelerating sustainable large-scale development of wind power in both grid-connected and off-grid village power applications in China. Cooperative projects in this area include: the Xiao Qing Dao Village Power Project where NREL and China's State Power Corporation are developing a pilot project using a wind/diesel/battery system to electrify 120 households on an island called Xiao Qing Dao located in the Yellow Sea off Shandong Province; training on various topics including wind resource assessments, hybrid systems modeling, and wind utility interconnection modeling.

Cooperation in *Renewable Energy Business Development* activities have included: DOE/NREL workshops and outreach activities which helped U.S. companies facilitate business partnerships and develop markets for renewable energy technologies in China; a review of the status of PV technology and industry development in China; a workshop and study tour for U.S. companies to introduce them to potential new customers, distributors and partnerships; completion of a Web site at www.nrel.gov/china that provides information on the U.S./China Bilateral Protocol on the Utilization of Energy Efficiency and Renewable Energy Technologies as well as business and policy information for companies that are interested in the Chinese markets.

Cooperation in *geothermal production* has included: identification of three demonstration sites for three buildings, totaling 3.2 million square feet, leading to purchase agreements between building owners and U.S. GHP manufacturers yielding sales more than \$5.2 million, the vast majority of which will go to U.S. firms. Cooperation in *Renewable Policy and Planning*, an Annex signed with China's State Development Planning Commission in May 2000, which provides for cooperation in support of China's rural electrification program to bring renewable energy sources to remote areas, such as in western China. The accomplishments include:

- National Township Electrification Program – DOE/NREL and SDPC held a Village Power Sustainability Workshop in Beijing in Dec 2002 to support the \$240 million renewable energy-based rural electrification program that will provide electricity to 1061 townships. The workshop attracted a dozen foreign experts and 70 Chinese government, service company and systems integrator company representatives and resulted in key discussions about load management, use of hybrid systems, the energy service company approach, rational tariffs, productive uses, and other factors that support sustainability. The next stage of the program will provide service to the

remaining 20,000 unelectrified villages. The workshop proceedings are available at:
www.nrel.gov/china/vp_workshop_2002.html.

- Brightness Program Training Certification – NREL and the Institute for Sustainable Power (ISP) are working with the Jikedian Renewable Energy Center to establish a training certification program for the Brightness Program. An initial evaluation of the Brightness program and training levels was conducted by NREL and ISP in China in Sep 2001, and in Mar 2002, 4 delegates from Jikedian trained at the Solar Energy Institute in the U.S. In 7/02, these delegates held a training for solar home systems in Beijing for trainers from 3 provinces and were certified as Master Trainers. This framework may be extended to include the village systems in the Township Electrification Program.

In addition to these Annex activities, DOE/NREL successfully held a U.S./China Renewable Energy Forum on April 19-20, 2000 in Washington, DC. Approximately 125 participants attended, including 50 Chinese delegates and 24 U.S. companies. A CDROM of the proceedings was mailed out in July 2000. A progress report on cooperation under the Energy Efficiency and Renewable Energy Protocol from April 2000 is available at NREL's Web site at www.nrel.gov/china/protocol.html.

Global Climate Change

The United States has worked closely with China on climate change issues through the U.S. Country Studies Program (USCSP) in support of the United Nations Framework Convention on Climate Change. DOE has provided financial support and technical assistance (approximately USD \$2 Million) through USCSP for China's Country Study, started in 1994. It was China's first nationally integrated comprehensive country study dealing with issues and mitigation strategies in climate change. The China Country Study work was led by the Ministry of Science and Technology (formerly the State Science and Technology Commission) in cooperation with scientists and analysts from more than 12 ministries and institutions. Tsinghua University did most of the coordination in the Study. The China Country Study was completed in 1998. The Country Studies Program also assisted China in the development of its Climate Change National Action Plan with support from DOE focused on energy efficient and renewable energy as well as climate friendly technology assessment for potential mitigation measures suitable to China's current situation.

The U.S. is also assisting China in developing socioeconomic modeling capabilities to facilitate China's evaluations of climate change policy adaptations. Currently DOE is working with Tsinghua University, a major advisory source for the government on climate issues, to develop a energy technology systems analysis modeling framework. This framework will help China establish capabilities in analyzing the effects of climate change policy on the Chinese economy. It will also identify important technology opportunities for the mitigation of carbon emissions.

Fusion Energy

The technical areas in the 1999-2000 Fusion Program of Cooperation with the Chinese Academy of Sciences included plasma physics, fusion technology, advanced design studies and materials research with 21 exchange items involving a total of approximately 40-45 U.S. and Chinese participants. The modest level of U.S.-PRC work in fusion energy science has been and

continues to be a productive technical interchange focusing on fusion science and technology including basic plasma physics and is mutually beneficial in promoting each others fusion research programs.

Both sides in a program review meeting in August 2002 approved the 2002-2003 U.S.-China Fusion Bilateral Program. The Bilateral Program includes activities under Plasma Physics, Fusion Technology, and Power Plant Studies. The modest level U.S.-PRC bilateral work in fusion energy science has been and continues to be a productive technical interchange focusing on fusion science and technology including basic plasma physics. Unfortunately, due to budget limitations on both sides and the recent SARS outbreak, exchange visits in the areas of Fusion Technology and Power Plant Studies were postponed. Communications are continuing between U.S. and PRC contacts for planning exchanges to be held when feasible. The current program is balanced in various ways: 1) focusing on theory, experimental and design; and 2) includes laboratories, universities, and industry.

In the area of Plasma Physics, GA and FRC-TX will continue to provide technical assistance to China's HT-7U design team, as appropriate, and to continue experimental collaboration on HT-7 experiments. The HT-7U superconducting tokamak is under construction at the Institute of Plasma Physics (ASIPP) in Hefei and is expected to be completed within two years. The FRC-TX successfully completed the Helimak fabrication project with ASIPP and Chinese industry. PPPL scientists collaborated with SWIP in transport modeling of HL-2A plasmas (new HL-2A research facility) and the study of ECH driven MHD effects on HL-1M. Arrangements have been made for the transfer of the TEXT tokamak from FRC-TX to HUST that is expected to occur by the end of October 2003. An ASIPP scientist visited GA for five months to collaborate on improvement of the magnetic reconstruction code EFIT. A LLNL theorist installed the BOUT edge turbulence code on the ASIPP Linux Cluster.

High Energy Physics

The program of collaboration has had many scientific accomplishments over the 20+ years of its operation. The program has led to the creation of a world-class accelerator with unique capabilities at the Institute for High Energy Physics (IHEP) in China, the formation of a joint international team involving eight U.S. universities and laboratories to exploit this accelerator for research, and collaboration on multiple projects with the participation of PRC and U.S. laboratories. The Collider (BEPC), whose design and construction occupied the early years of the PRC/U.S. program, has operated very well for many years. At the present time, the core activities of the PRC/U.S. program is collaboration on: 1) the Beijing Electron Positron Collider (BEPC); 2) the Beijing Spectrometer (BES), its dedicated detector; and 3) the Beijing Synchrotron Radiation Facility (BSRF). Important experimental results have been, and continue to be obtained from both BES and BSRF. One of the most important (from the BES) has been the world's most precise measurement of the mass and the lifetime of the tau lepton.

Important areas of cooperative work on experiments in the U.S. between IHEP and U.S. laboratories include collaboration on: 1) the B-factory project at the Stanford Linear Accelerator Center (SLAC) B both the collider (PEP-II) and its detector (BaBar), for which the Chinese have built important components; and 2) the PHENIX experiment at Brookhaven National Laboratory's (BNL's) RHIC facility, which is a relatively new element of cooperation.

The planned major upgrades of BEPC and BES to BEPC II and BES III are becoming the principal focus of this Cooperative Program. The Committee reviewed the considerable progress that has occurred since the meeting a year ago, when the committee first heard that the upgrade project had been approved by the Chinese government and was given an introduction to the plans. Meetings to plan international cooperation on BEPC II and BES III were held in Beijing in April 2001 and October 2001, respectively.

Other important areas of cooperative work between IHEP and U.S. laboratories have been successful and both sides expressed their desire to strengthen the collaboration. In particular, the Committee heard the plans for Chinese participation in the Time-of-Flight particle identification system for the STAR detector at RHIC.

The Committee agreed to a program of cooperative activities for the period October, 2002 to October, 2003 between IHEP and SSRC and the U.S. High Energy Physics Laboratories.

Energy Information Exchange

From 1995 to January of 2000, DOE's Energy Information Administration (EIA) and China's National Bureau of Statistics (NBS) cooperated under a Statement of Intent (SOI) for information exchange. Under this arrangement, five exchange meetings took place to discuss the status of energy supply and demand and to exchange information on methods of data collection and processing of energy information. The EIA has provided extensive published energy information and the NBS has provided publications on coal, petroleum and electric power in China. A protocol to replace the SOI was signed in January 2000. The protocol provides specific areas of information not mentioned in the 1995 SOI.

The protocol calls for exchange of information about energy resources and reserves, energy production, energy demand, energy investment, environmental emissions and statistical information about the adequacy of energy resources to meet demands on the future. The protocol also allows for DOE to provide training in energy statistical data survey, data processing systems and statistical analysis as well as training in the indicator systems about impact of energy on environment, survey technologies and data account.